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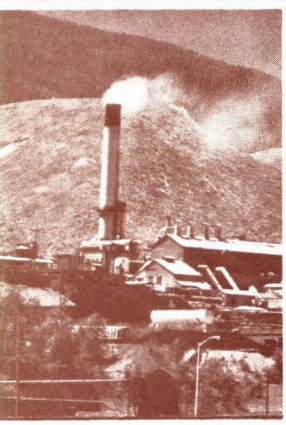

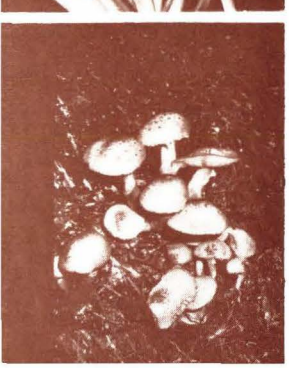

FOREST ENVIRONMENTAL PROTECTION

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EVALUATION OF DOUGLAS-FIR BEETLE INFESTATIONS, NORTH FORK CLEARWATER RIVER DRAINAGE, IDAHO -- 1974

by

D. R. Hamel,[1/] R. D. Oakes,[2/] M. D. McGregor,[1/] and R. C. Lood[3/]

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ABSTRACT

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk., has caused extensive tree mortality in the North Fork Clearwater River drainage since 1971. In 1974, survey estimates indicated a continued decline in the infestation. Average group size decreased from a high of 158 trees per group in 1971 to 17 in 1974. Average area occupied by each group declined from a high of 4.1 acres per group in 1972 to 0.65 acre in 1974. Attack densities decreased; however, brood-to-parent ratios increased. Natural enemies are having a limited impact on population densities. Availability of susceptible host material may be the primary limiting factor on increased infestation potential. Continued salvage logging of infested trees and susceptible stands is encouraged.

INTRODUCTION

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk., is the most destructive bark beetle of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, in the Northern Region. In the past, outbreaks have been initiated by windfalls, snow breakage, drought, and fire injury (Furniss and Orr, 1970). The last outbreak in the Clearwater drainage occurred from 1950 to 1952 (Evenden, 1952).

1/ Entomologist, Forest Environmental Protection, State and Private Forestry, USDA, Forest Service, Missoula, Montana.

2/ Biological Technician, Intermountain Forest and Range Experiment Station, USDA, Forest Service, Moscow, Idaho.

3/ Biological Technician, Forest Environmental Protection, State and Private Forestry, USDA, Forest Service, Missoula, Montana.

The current infestation was detected in the spring of 1971[4/] and has been surveyed yearly (Ciesla et al., 1971; McGregor et al., 1972; McGregor, 1973; and McGregor et al., 1973). The zone of infestation occupies lands owned or administered by Potlatch Corporation, Diamond International Co., State of Idaho, Bureau of Land Managment, U.S. Army Corps of Engineers, and the Clearwater National Forest.

Objectives of sampling have been to:

1. Determine impact of the beetle on Douglas-fir stands in the North Fork drainage,
2. Determine infestation trend,
3. Improve methods of measuring beetle-caused losses in the Northern Region,
4. Initiate salvage logging to, in part, recover losses.

Results of the 1974 survey are reported here.

METHODS

Prior to ground surveying, sketch maps of 1973 infested tree groups were made during aerial reconnaissance surveys on August 12-13. Ground surveys were conducted from mid-September through October. Groups of infested trees were examined to determine degree of success of attacks. Bark samples were removed with a cruiser's axe from between 5 and 6 feet up the infested bole to expose beetle galleries. Each successfully attacked tree was numbered to facilitate location later when bark punch samples and other data were taken. All trees were measured for diameters (d.b.h.), and a representative number of heights and ages of both successfully and unsuccessfully attacked trees were taken.

Ten successfully attacked trees were chosen, by restricted random sampling, for bark punch sampling. Trees were selected to cover the full range of diameters represented in each group. In groups with 10 or fewer successfully attacked trees, all trees were sampled. Two samples between 12 and 14 feet above the ground were removed with a one-tenth square foot bark punch (Furniss, 1962). In each bark sample, number of gallery starts (attacks), inches of parent gallery, overwintering brood, and natural enemies (parasites and predators) were recorded.

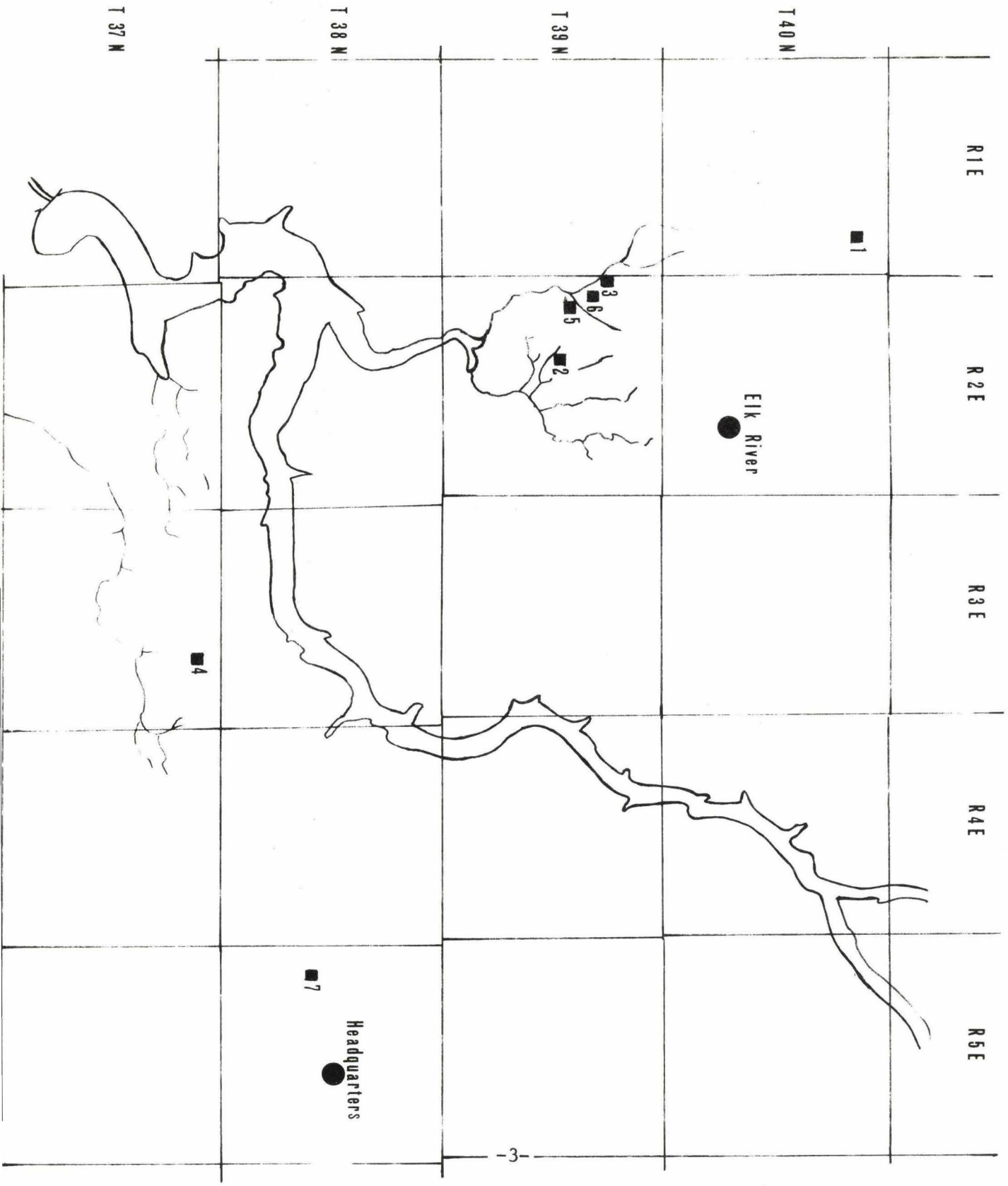
Due to difficulties encountered in locating newly infested groups, most of the 1974 sampling occurred in the Meadow Creek drainage near Elk River (Figure 1). A total of seven infested tree groups were sampled.

4/ M. O. Koppang (pers. comm.) Clearwater-Potlatch Timber Protective Association. Orofino, Idaho. July 1, 1971.

Figure 1

Douglas fir beetle infestation, Clearwater National Forest, Idaho 1974.

■ Plot locations.



RESULTS

The Douglas-fir beetle has caused extensive losses during the past 4 years in the North Fork Clearwater drainage. Survey estimates indicate that in excess of 248,000 trees containing more than 111 million board feet have been killed during this period.

The infestation has been declining since it was first detected in 1971. For example, average group size has fallen from a high of 158 trees per group in 1971 to a low of 17 in 1974. Characteristics of groups sampled during this period are summarized in Table 1.

Table 1.--Summary of Douglas-fir beetle groups inventoried for population sampling, North Fork Clearwater River, Idaho, 1971-1974.

Year	Tree groups sampled	Number of trees in sampled groups	Average number trees/group	% successfully attacked trees
1971	3	475	158	78
1972	11	873	79	42
1973	15	326	22	71
1974	7	121	17	65

Average area occupied per group has also declined. In 1971, average area per infested group was 3.7 acres. This increased to 4.1 acres in 1972,and decreased to 1.1 acres in 1973. By 1974 the average area of groups sampled was 0.65 acre (Table 2).

Table 2.--Summary data for Douglas-fir beetle sample groups, North Fork Clearwater River drainage, Idaho--1974.

Group No.	Location			Group dimensions				Topography		
	T(N)	R(E)	Sec.	L (ft.)	W (ft.)	Area (acre)	Elev. (ft.)	Ridge	Slope	Aspect
1	40	1	11	135	250	0.77	3,635	x		N
2	39	2	21	175	170	.68	2,820		x	SSW
3	39	2	7	55	35	.04	2,900		x	WSW
4	37	3	10	20	42	.02	3,040	x		SSW
5	39	2	17	210	320	1.54	2,950	x		NNW
6	39	2	7	150	200	.69	3,100		x	WSW
7	38	5	19	225	150	.77	3,500		x	NW
Average/ Group				139	167	0.65				

Diameters, ages, and heights of 1974 attacked trees were generally larger than for unsuccessfully attacked trees (Table 3), as occurred in previous years (Table 4).

Table 3.--Summary of tree data, Douglas-fir beetle attacked trees in sample groups, North Fork Clearwater River drainage, Idaho--1974

Group No.	No. trees attacked				D.b.h. (average)			Age (average)[1/]			Height (average)		
	Σ[2/]	S[2/]	U[2/]	%S	S	U	$\bar{X}$[2/]	S	U	$\bar{X}$	S	U	$\bar{X}$
1	27	13	14	48.0	19.8	18.8	19.3	112	109	110	118	93	107
2	10	5	5	50.0	16.3	16.7	16.5	73	84	79	107	123	115
3	6	3	3	50.0	20.2	10.1	15.2	111	91	101	130	87	108
4	4	2	2	50.0	21.4	18.9	20.1	106	85	96	117	108	113
5	26	23	3	88.0	20.7	19.7	20.5	117	118	117	124	133	126
6	24	15	9	63.0	19.0	14.0	17.1	96	93	95	118	89	105
7	24	15	9	63.0	20.5	20.3	20.4	154	154	154	130	135	132
Average/ group	17	11	6	63.6	19.7	16.9	18.4	110	105	107	121	110	115

1/ Age (measured at breast height)
2/ Σ = total; S = successful; U = unsuccessful; $\bar{X}$ = average.

Table 4.--Summary of tree data, Douglas-fir beetle attacked trees in sample groups, North Fork Clearwater River drainage, Idaho, 1971-73.

Year	D.b.h.			Average per group					
				Age			Height		
	S	U	$\bar{X}$	S	U	$\bar{X}$	S	U	$\bar{X}$
1971	18.8	15.8	17.3	97	--	--	--	--	--
1972	19.2	18.1	18.7	122	113	118	119	108	114
1973	21.1	16.0	18.6	115	121	118	117	100	109

Attack density declined to its lowest average of the 4 years during 1974 (Tables 5 and 6). Gallery lengths on bark samples were equal to those during 1973. Surviving brood per parent (brood/parent ratio) was highest in 1974, being about three times that of other years.

Table 5.--Summary of bark punch sample data, North Fork Clearwater River drainage, Idaho, 1971-73

Year	No. samples (total)	Galleries		Average per square foot								
				Douglas-fir beetle brood				Brood/ parent ratio	Natural enemies[1/]			
		No. starts	Length (inches)	Larvae	Pupae	New adults	Total		Tc	Cl	M	Cb
1971	122	10.6	73.9	2.2	1.1	20.3	23.6	1.11	0.08	0.20	0.70	11.1
1972	182	12.6	--	4.7	1.0	21.2	26.9	1.07	--	.05	.20	13.0
1973	242	9.5	57.2	--	--	14.3	14.3	.82	.30	--	1.03	5.0

1/ Natural enemies: Tc = *Temnochila chlorodia*, Cl = *Enoclerus sphegeus*, M = *Medetera* sp., Cb = *Coeloides brunneri*.

Table 6.--Summary of bark punch sample data, North Fork Clearwater River drainage, Idaho, 1974

Group No.	Number samples	Galleries: Total number starts	Galleries: Total length (inches)	Douglas-fir beetle brood: Larvae	Pupae	New adults	Total	Brood/ parent ratio	Natural enemies 1/: Tc	Cl	M	Cb
1	20	14.0	140.4	1.0	2.0	33.0	36.0	1.28		1.0	5.0	33.0
2	10	5.0	64.2		2.0	18.0	20.0	2.00			5.0	5.0
3	6	2.0	40.5	6.0		14.0	20.0	5.00			3.0	4.0
4	4	0	32.7			13.0	13.0				3.0	4.0
5	20	10.0	109.4	2.0		56.0	58.0	2.90			6.0	17.0
6	20	19.0	83.5	3.0	2.0	115.0	120.0	3.16			3.0	22.0
7	20	19.0	103.7	4.0	1.0	74.0	79.0	2.08			1.0	20.0
Average/ sq. ft.		6.9	57.4	1.6	.7	32.3	34.6	2.74		0.1	2.6	10.4

1/ Natural enemies: Tc = *Temnochila chlorodia*; Cl = *Enoclerus sphegeus*, M = *Medetera* sp., Cb = *Coeloides brunneri*.

In 1974, the larval parasite, *Coeloides brunneri* Vier., was the most prevalent natural enemy followed by a predaceous fly larva, *Medetera* sp. (Table 6). Predatory beetle larvae including the ostomid, *Temnochila chlorodia* (Mann.) were almost totally absent, with only one clerid larva, *Enoclerus sphegeus* Fab., encountered. However, larvae of this beetle are known to migrate to the root crown during the fall.

DISCUSSION

Douglas-fir beetle populations are continuing to decline in the North Fork Clearwater River drainage. Only a limited number of groups were available for sampling in 1974 but it was apparent that group size, area, and overall number of attacked trees declined from an average of 22 trees per group in 1973 to 17 trees per group in 1974. Area of infested groups decreased from 1.1 acres per group to 0.65 acre per group during the same period. Although decreases in overall population were noted, the brood-to-parent ratio increased. In areas surveyed the brood/parent ratio was 2.51:1, a threefold increase over 1973. Reasons for the increase in brood-to-parent ratio are not clearly understood, but the severe drought of 1973 may have contributed to tree stress which could have resulted in greater brood survival (Rudinsky 1966). The reversed ratio could also be attributed to the fact that fewer parent beetles were attacking in 1974 (attacks averaged 6.9 per square foot compared to 9.5 per square foot in 1973); therefore, less intraspecific competition would have resulted in greater brood survival (Schmitz and Rudinsky 1968).

Whatever the reason for the increased ratio, an increased attack density may occur in 1975; however, if a decrease in number of susceptible trees throughout the overall area of infestation has occurred, the decline should continue.

Another factor favoring population decline is the progressive removal of infested and susceptible green trees from infested areas. In 1974 land managers salvage logged more than 47 million board feet of timber (in and around the zone of infestation) (table 7).

Table 7.--Summary of salvage logging operations of bark beetle infested Douglas-fir, North Fork Clearwater River drainage, 1971-1974

Year	Volume salvage logged by ownership (board feet)				
	State of Idaho	Clearwater National Forest		Potlatch Corp.	Total
		Palouse RD	Canyon RD		
1971	2,327,400	0	0	2,746,000	5,073,400
1972	6,870,000	1,805,000	1,200,000	10,071,000	19,946,000
1973	4,735,720	110,000	0	10,711,000	15,556,720
1974	2,000,000	2,050,000	20,000	3,200,000	7,270,000
Total	15,933,120	3,965,000	1,220,000	26,728,000	47,846,120

Additional sales are being scheduled by these landowners for 1975, and the U.S. Army Corps of Engineers is tentatively planning to salvage approximately 5 million board feet by means of helicopter sale on slopes adjacent to Dworshak reservoir.

Removal of susceptible green trees and continued salvage of infested timber is encouraged to maintain the population decline. However, the trend could be reversed by such factors as severe drought, windthrow, or snow breakage.

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